

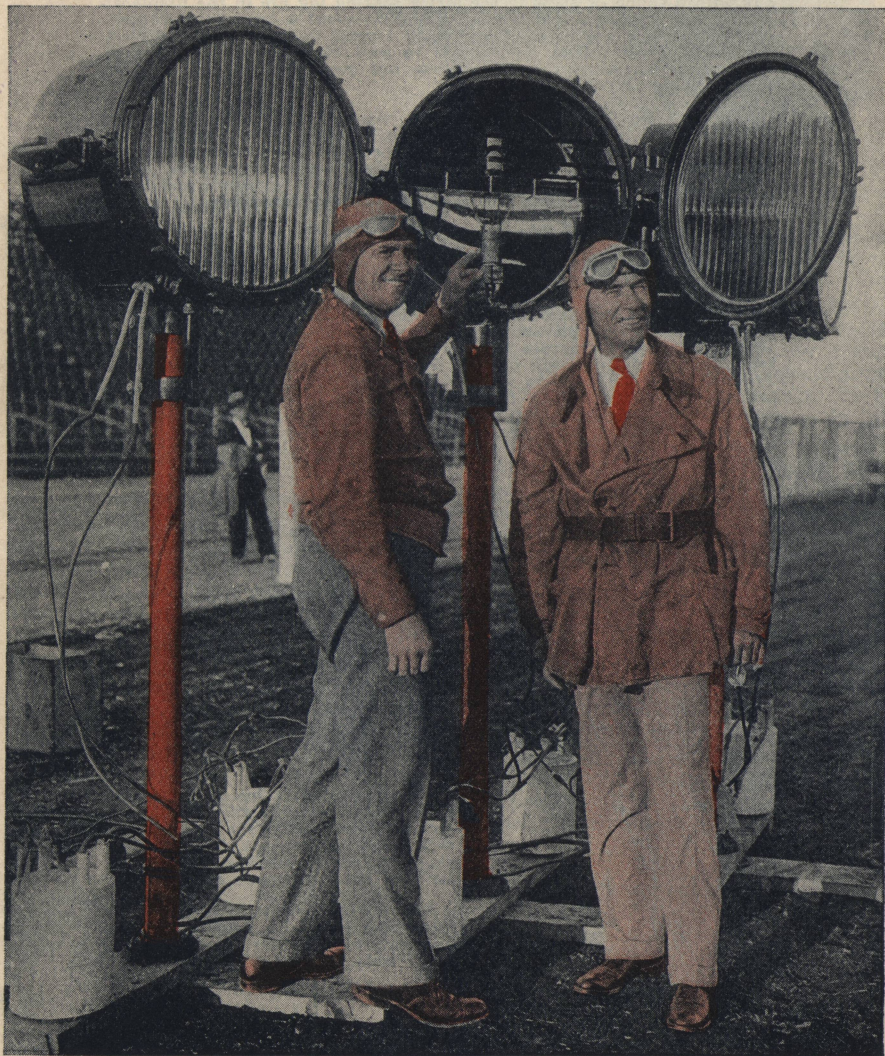
CHICAGO ENGINEERING REVIEW

The Monthly Publication of the L. L. Cooke School of Electricity

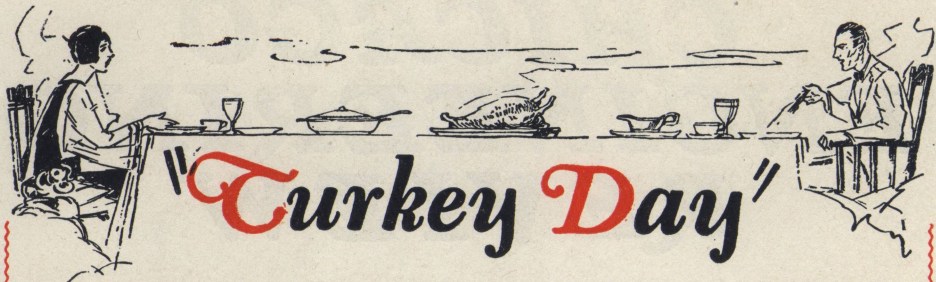
Vol. IX, No. 7-8

NOVEMBER-DECEMBER, 1928

Price 10 Cents



Automatic searchlights to aid night flyers. The hum of an approaching airplane propeller, picked up by a microphone and amplified, operates the mechanism which turns on the lights.



T HANKSGIVING time again!

Somehow "Thanksgiving" always makes me think of a crisp, cold day with a touch of snow in the air; a roaring log fire in the fireplace; a long table with piles of fruits and cakes—and a huge roast turkey. And it reminds me of a kindly voice I used to hear saying, "Well, son, what good things have come to you this year? What worth while things have you done? What are you thankful for, on this Thanksgiving Day?"

It's an old custom and a good one, the giving of thanks on "Turkey Day." Every one of us has many things to be thankful for—more, in fact, than we realize. We are apt to think more about our troubles, our hard luck, than about all the good luck we have. It is only at a time like Thanksgiving, when we really sit down and think it over, that we appreciate how many good things we have.

Are you kind of "down on your luck"—do you feel that you haven't very much to be thankful for? Then let's check over, just as a reminder, some of the good things you have, which far surpass any bad luck that may have come your way.

You should be thankful first of all for OPPORTUNITY. The day is past when any man can say he has no opportunity to get ahead. Today the way to Success is open to every one. Particularly is this true in Electricity, your chosen field. Never was the demand for Trained Electrical Experts greater than now. Never was it easier to get started and climb to the top in this wonderful profession than now. Never were salaries higher and promotions more rapid than now. Be thankful that you have an Opportunity like this. Thirty years ago—even ten years ago, men had no such Opportunities as you have today.

Be thankful also that you can take advantage of this Opportunity. Through Cooke Training you can quickly fit yourself for the best that Electricity has to offer. By putting in a half hour or an hour every day for just a few months on your lessons, you can get ready for the kind of a job you want.

Be thankful that you are living in an age and in a country where wealth, and social position, and "pull" don't count half as much as what you are. Be thankful that when you study and put your best efforts into training for Electricity, that you'll be able to use that training to make more money.

And be thankful most of all that you have already made a start on the Road to Success—that you are a Cooke Student and as such are already in line for a big future in Electricity. There's an old saying, "Well begun is half done." You have made the start—now carry through on your undertaking.



Decide now that by next Thanksgiving you'll have finished my Course and be a real Electrical Expert. Decide that you won't let anything stand in your way—that you will go forward every day and every week.

Make this decision NOW, and I'll guarantee you'll be doubly thankful you did it next year when "Turkey Day" rolls around.

L. L. COOKE.

A Few Helpful Suggestions for Testing Alternating Current MOTORS



Fig. 1.
The Meggar
Used for
Testing
Insulation.

I cannot over emphasize the importance of the insulation on the windings on electrical machines for satisfactory operation and service. Insulation resistance is the opposition to current flow, offered by any insulation substance, such as rubber, varnished cambric, mica, etc.

Insulation resistance decreases with increase of temperature, whereas the resistance of a metallic conductor increases with temperature. If a generator runs hot, the resistance of the insulating material around the conductors becomes less. More current will leak through the insulation and this in turn is followed by more heating of the insulation. Finally a point is reached where the insulation chars and breaks down. This precisely is the reason that heat limits the capacity of a generator.

A great deal of expensive maintenance work may be avoided by testing the resistance of electrical machines at regular intervals. If a test shows the insulation resistance to be lower than normal, the necessary repairs may be made at once, preventing a complete

shut down later on when a burn-out occurs, due to complete failure of the insulation.

One of the most convenient devices for testing insulation resistance is the meggar, shown in Fig. 1. By testing with the meggar between ground and each motor terminal separately, the insulation resistance is shown on the scale of the meggar.

An electrical machine must be insulated so that there is no danger of short circuits occurring between the different turns of any one coil, or between two adjacent coils that may be placed in the same slot and also, so that there will be no danger of any conductor coming in contact with the frame of the machine under normal conditions. There is, of course, a great deal more danger of short circuits and grounds occurring on high voltage machines, therefore they require thicker and better insulation than low voltage machines.

Naturally, when a generator or motor is rewound or in fact if it is repaired merely by replacing a coil or two, the

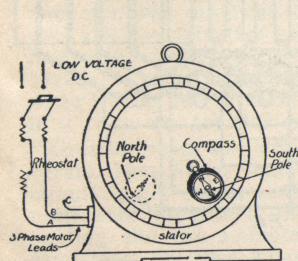


Fig. 2

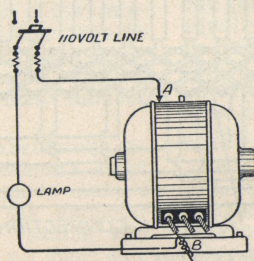


Fig. 3

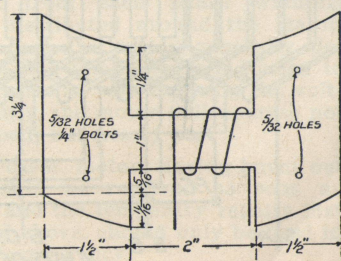


Fig. 4

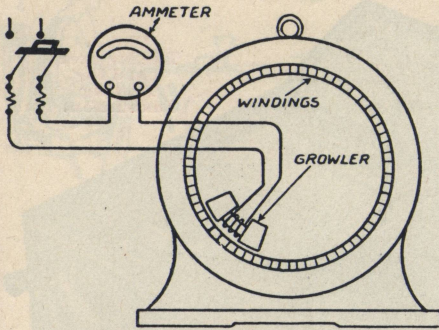


Fig. 5

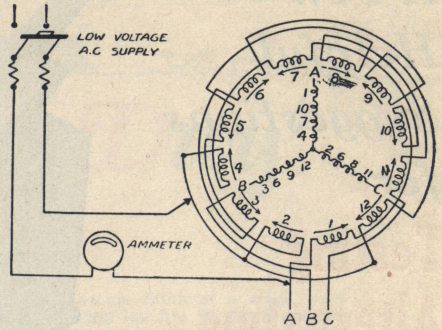


Fig. 6

armature or stator should be thoroughly dried out, then dipped in an insulating compound, and baked just exactly the same as in building a new motor.

After the stator of an alternating current motor has been rewound or reconnected, the windings should be tested very carefully for faults in the connections and winding. They should first be checked over very carefully in connection with the wiring diagram, to guard against errors in the connections. One of the most important tests to make at this time is what is known as the polarity test. This should be done, however before the winding is dipped in the insulating compound and baked, because it is best to change the connections, if necessary, before dipping.

In making a polarity test, use a compass and a low voltage direct current. Pass a small amount of direct current through each phase separately, having a rheostat in series with the direct current line to limit the current. The direct current flowing through the winding will set up alternate North and South poles in the phase which is excited. Pass the compass around the inside of the stator as in Fig. 2 and mark

the poles on the stator with a piece of chalk. Mark the poles set up by the direct current in each phase with different color chalks and check the markings. The poles should be alternately positive and negative and equally spaced around the stator.

If the poles are not alternately positive and negative, or if they are not spaced, a reverse coil or coil group is indicated. When making the compass test on a 2 phase machine, there would be twice as many chalk marks as there are poles. In a 3 phase winding, there will be 3 times as many chalk marks as there are poles.

Fig. 3 shows the method of testing the windings of a motor for ground with 110 volt D. C. test circuit. You could use an alternating current test circuit, if you so desire, but you may get a faint spark when testing the windings for a ground even when there is no ground. This is due to a slight inductive effect taking place between the windings and the frame of the motor and may lead you to believe that you have a grounded motor when you do not have. If the windings of your motor are grounded, applying the test as

SHORT CIRCUITED COIL

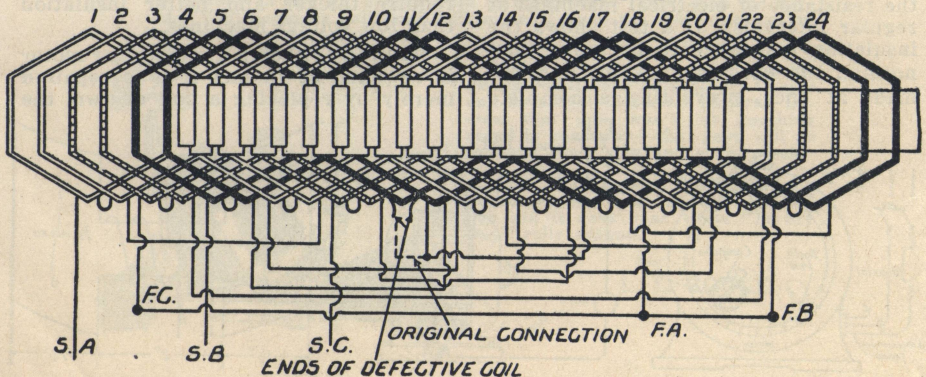


Fig. 7

shown in Fig. 3 will cause the lamp to light; if they are not grounded the lamp will not light. Such a test may be made with a magneto or bell test set, if desired.

When the windings of a motor are found to be grounded, the trouble may be often located by a careful inspection of the winding and in some case the terminal connections. If a careful examination of a winding does not enable you to locate the ground, connect the terminal B of the test circuit shown in Fig. 3 to the terminal of the grounded winding and hold terminal A firmly against the frame of the machine. In most cases sparking or smoking will be noticed at the grounded point. If this test does not disclose the location of the ground, open the winding at several points and test each section separately. After the grounded section is located, it must be opened at different points and test continued until the grounded coil is found.

One of the most convenient devices for locating short circuits in a stator winding is a growler or short circuit testing device. In Fig. 4 is shown the connections and electrical circuit for a growler suitable for testing either stator or rotor windings, using the current from a 110 volt 60 cycle alternating current line. When testing stator windings, the growler should be connected to a 110 volt alternating current line with an ammeter and fused switch in series. It should then be placed inside the stator, connected to the A. C. line as shown in Fig. 5. Note the reading on the ammeter and then move the growler completely around the inside of the stator. If the reading on the ammeter does not change when the growler is moved around the stator, there are no short circuits. If the reading on the ammeter increases when the growler is moved to a certain point, it is an indication that the growler is passing over one side of a short circuited coil. If it is impossible to determine just which coil is short circuited, hold the growler in position at which the greatest deflection of the ammeter was observed for a few minutes and the defective coil may then be located by feeling them with the hand, because a short circuited coil will become warm, due to the current induced in it from the growler.

Growler tests are not absolutely accurate, because in some cases a short circuit is not severe enough to make a noticeable difference in the ammeter reading and the ammeter reading will sometimes increase when no short cir-

cuit exists, due to dust or varnish on the stator case.

Another test known as the balancing test for 2 and 3 phase windings, is shown in Fig. 6. This test is made by passing a low voltage alternating current through each phase separately and figuring the amount of current flowing through each phase. If the current through one phase is greater than through the others, a short circuit is indicated. The method of making a balance test on a 3 phase Star connected winding is shown in Fig. 6.

An open circuit in any phase winding may be detected by a balance test or by testing each phase with a test circuit. If the test discloses an open circuit in one phase, it may sometimes be located by careful inspection of the windings. If an inspection does not disclose the exact location of an open circuit, open the phase winding at several different points and test each part until the trouble is found.

Cutting Out Coils for Motor Windings

Quite frequently, one or more coils of an induction motor winding will burn out at a time when it is impossible to remove the motor from service while repairs are being made. In such cases, temporary repairs may be made by cutting out the defective coil and taping the ends carefully, so that they cannot come in contact with each other as I have shown in Fig. 7

In referring to Fig. 7 the defective coil as it is represented may be shorted or it may be opened, or the coil may be grounded, causing trouble in the operation of the motor, but in either case it may be cut out and the motor used temporarily. If no more than one or two coils in any phase of a motor burn out, the defective coils may be cut out as I have shown and the motor operated temporarily. However, if more than two coils of one phase winding burn out, the same number of coils must be cut out from each phase winding, equally distributed around the stator. In this case the motor generally develops a high temperature if loaded to its full capacity. By reducing the voltage slightly, the motor will operate not at full load, but nearly so.

In all cases, motors having burnt out coils should be repaired as soon as possible and the temporary repairs just described above, should only be used in cases of emergency.

Some
Interesting
Facts
About

Electric Arc WELDING

(PART II)

This is the second installment of a two-part article on Electric Arc Welding. The first part appeared in the September-October Review and covered Electric Welding equipment and requirements. This installment deals with the actual processes of making electric welds.

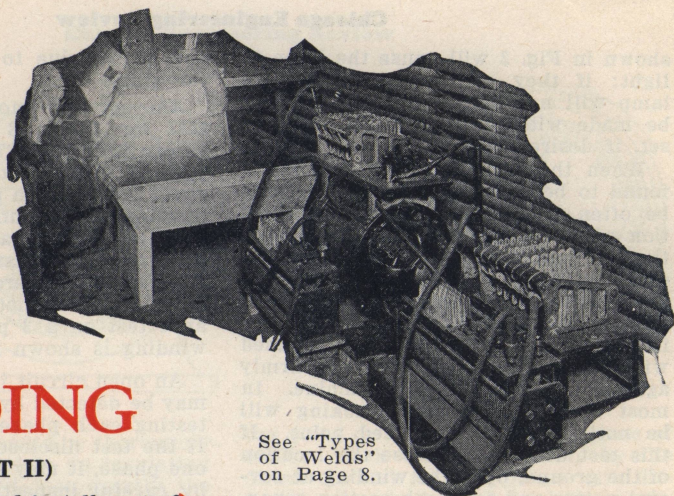
The Characteristics of a Good Weld

THERE are several conditions which determine the physical characteristics of a good metallic electrode weld. These are fusion, flash contents, porosity and crystal structure. One with a trained eye can readily tell by looking a weld over as to its character by the finish of the surface by the length of the deposit which shows how often the arc was broken, by the uniformity of the deposits and by the appearance of the upper side of the weld which shows the fusion of the deposited metals in the bottom of the weld. Each of these reflect back upon the skill of the workman.

A degree to which the deposited metal adheres can be determined by chipping the edges of the deposited layers with a cold chisel. The well trained inspector can generally tell the nature of the weld by merely looking it over carefully.

Since successful welding requires well trained and skilled operators, several large companies manufacturing welding apparatus and equipment have opened up training departments where men can go and receive training for a period of 8 weeks, entirely free of charge. Thus, those who are interested in this line of work have excellent opportunities to prepare themselves for a good future.

The various types of joints that may be welded are the following: Strap, Butt, Lap, Fillet, Plug and Tee.



See "Types
of Welds"
on Page 8.

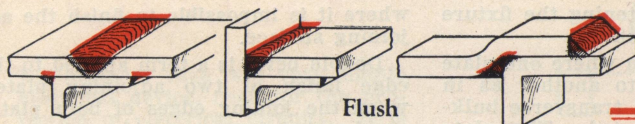
The Strap weld is one in which the seam of two adjoining plates or surfaces is reinforced by any form or shape to add strength and stability to the joint or plate. In this form of weld the seam can only be welded from the side of the work opposite the reinforcement and reinforcement of whatever shape must be welded from the side of the work to which the reinforcement is applied.

A Butt weld is one in which two plates or surfaces are brought together edge to edge and welded along the seam thus formed. The two plates when so welded form a perfectly flat plane in themselves, including the possible projection caused by other individual objects as frames, straps, stiffeners, etc., or the building up of the weld proper.

Lap weld is one in which the edges of the two planes are set one above the other and the welding material so applied as to bind the edge of one plate to the face of the other plate. In this form of weld the seam or lap forms a raised surface along its entire extent.

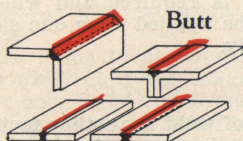
The Fillet weld is one in which some fixture or member is welded to the face of the plate, by welding along the vertical edge of the fixture or member of both the welds shown and marked A in the illustration. The welding material is applied in the corner thus formed and finished at an angle of 45 degrees to the plate.

Plug weld is one used to connect the metals by welding through a hole in either one plate. This is for the purpose of adding strength when fastening fixtures to the face of a plate by drilling a counter sunk hole to the fixture and applying the welding materials to

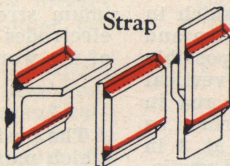


Flush

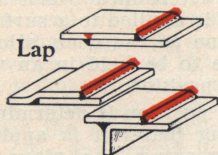
TYPES OF ELECTRIC WELDS



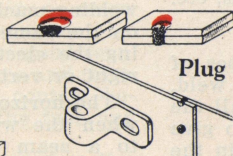
Butt



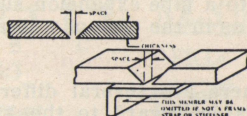
Strap



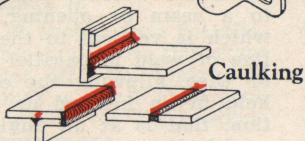
Lap



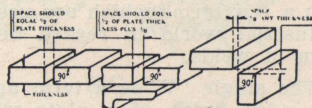
Plug



Double Bevel

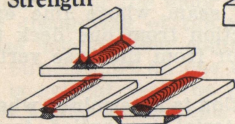


Caulking

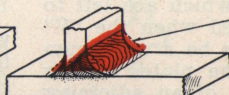


Straight

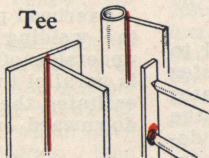
Strength



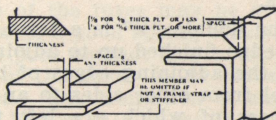
Concave



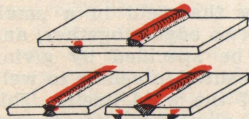
Tee



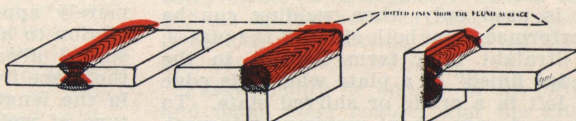
Tack



Single Bevel



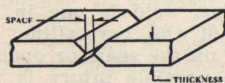
Composite



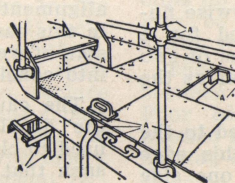
Reinforced



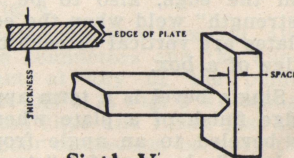
Double V



Fillet



Single V



this hole, thereby fastening the fixture to the plate at this point.

The Tee weld is one where one plate is welded vertically to another as in case of the edge of a transverse bulkhead such as illustrated. The plate marked A being welded against the shell plating. This is a weld which in all cases requires exceptional care and can only be used where it is possible to work from both sides of the vertical pipe. Also used for welding a rod in a vertical position to a flat surface as the round of a ladder shown at 3 in the illustration. A plate welded vertically to a pipe expansion such as shown at B as in the case of water faucets, etc.

Design of Weld

There are several different types of welds in regard to the kind of weld, the position of weld and first of all the design of weld and I am going to give you a few terms which are used in the industrial world in regard to the design of welds.

The single "V" is a term applied to the edge finish of a plate when this edge is beveled from both sides to an angle, the degrees of which are left to the designer to be used when the "V" side of the plate is to be a maximum strength weld, with the plates setting vertically to the base of an adjoining member and only when the electrodes can be applied from both sides of the work.

The double "V" is a term applied to the edge finished up to adjoining plates and the adjoining edges of both plates bevel from other sides to an angle, the degrees of which are left to the designer. It is used when the two plates are to be "butted" together along the two sides for maximum strength weld. It is used only when welding can be performed from both sides of the plates.

Straight is a term applied to the "edge finish" of a plate when this edge is left in a crude or shirred state. To be used only where maximum strength is not essential or unless used in connection with strap, stiffener or frame, or where it is impossible to otherwise finish the edge, also to be used for a "strength" weld when the edges of two plates are vertical to each other as the edge of a box.

Single bevel is a term applied to the edge finish of a plate when this edge is beveled to an angle from one side only. To be used for "strength" welding, when the electrode can be applied from one side of the plate only, or

where it is impossible to finish the adjoining surface.

Double bevel is a term applied to the edge finish of two adjoining plates, when the joining edges of both plates are beveled from one side only to an angle, the weld to be used where maximum strength is required and where electrodes can be applied from one side of the work only.

Position of Weld

The position of weld is another factor which must be taken into consideration in doing various kinds of welding. A flat position is determined when the welding machine is applied to a surface on the same plane as the deck, allowing the electrode to be held in an upright or vertical position.

The horizontal position is determined when the welding material is applied to a seam or opening, the plane of which is vertical to the deck and the line of weld is parallel with the deck or base, allowing the electrode to be held in an inboard or outboard position, that is at an angle to the horizontal plane.

The vertical position is determined when the welding material is applied to a surface or seam whose line extends in a direction from one deck to the deck above or from the base vertically upward.

Overhead position is determined when the welding material is applied from underside of any member whose plane is parallel to the base or deck and necessitates the electrode being held in a downward or inverted position.

Kind of Weld

The tack weld is a term used when merely applying the weld in a small section to hold two edges together, and should always be specified by giving the space from center to center to weld in the length of the weld itself. This type of weld is alone used for temporarily holding materials in place, that is, to be solidly welded, until the proper alignment and position is obtained and in this case neither the kind or the design of weld are to be specified or taken into consideration.

The caulking weld is one in which the density of the crystalline metal, used to close up the seam or opening is such that no possible injury is visible under water oil or air pressure at 25 pounds per square inch. The ultimate

(Continued on page 14)

FUSES

and How to Use Them

THE ordinary fuse is a very simple electrical device, used for the protection of electrical circuits. It is the safety valve of the electric circuit and if properly used, provides protection for motors, lamps and other devices.

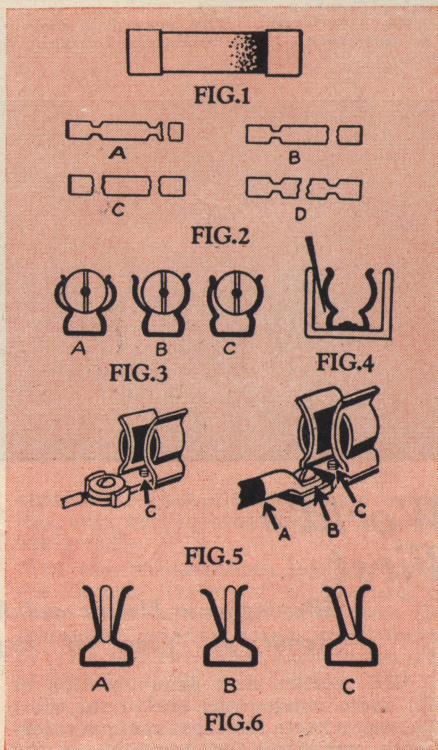
In order to accomplish the purpose for which they are designed, fuses must not only be of the proper size and rating, but must be installed correctly. A fuse is so simple that it would seem off-hand, that the only thing necessary when installing a new one is to place it between the supporting clips or screw it in the receptacle as the case may be. However, if a fuse is to give good service, it must fit snugly in place and there must be a good electrical contact between the metal parts of the fuse and the clips supporting it.

The subject of proper fuse installation and maintenance is so important that the Bussman Mfg. Co., makers of Buss fuses publish a small hand book on fuses from which the illustrations in this article were taken.

A great deal of fuse trouble is caused by poor contact which could be avoided. Charring of the ends of the fibre tube or discoloring of the metal ends of a fuse indicate poor contact. If the fibre is burned only on one end as in Fig. 1, it is evident that the poor contact exists at the burned end.

The way in which a fuse link is blown, serves as another indication of whether or not a poor contact existed. Fig. 2 shows four different views of renewable fuse links, all of which have been blown in different places. One blown as in Fig. 2-A indicates positively a poor contact. Fig. 2-B may have been blown by a normal overload, but it may indicate poor contact. One blown as in C shows the result of a heavy overload or a short circuit with good contact, while the one at D has been blown by a light overload, with a good contact.

Poor contact between the fuse and clips causes not only damage to the fuses, but to the clips as well. If there is a poor contact, the clips overheat, taking the spring tension out of them and making it necessary to replace them in a short time. The clips should be kept perfectly bright and clean on the inside by polishing them with emery cloth when necessary. The metal ferrules on the ends of the fuses should also be kept bright and clean in the



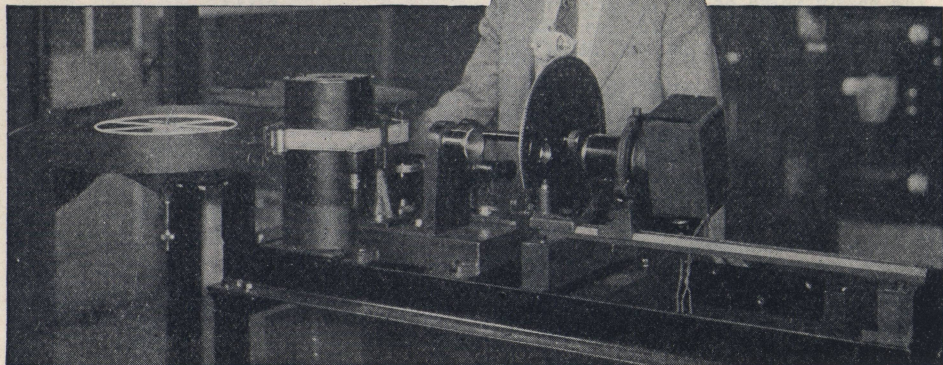
same way. Although both clips and the metal ends of the fuses may be bright and clean with a good spring tension in the clips, a poor contact may exist, due to failure of the fuses to fit correctly in the clips. This condition is shown in Fig. 3. In Fig. 3-A there is a very poor contact and heating will result at the clips long before the fuse is carrying its rated capacity. In 3-B and 3-C the contact between clips and fuses is not complete enough to prevent heating, even without overload.

Fuses should fit snugly in the clips and make good contact and the clips should hold the fuse firmly so that it cannot be easily turned. In case the clips do not hold the fuse firmly, they may be bent with a screwdriver as shown in Fig. 4.

There should be good contact also between the conductors and the clips. Poor contact at any of the points marked A, B and C in Fig. 5 will cause heating of the clips and fuses, just the same as a poor connection between the clips and the fuses.

(Continued on page 14)

Dr. Frank Conrad, Assistant Chief Engineer, Westinghouse Electric and Manufacturing Company, and the television motion picture projector. The scanning disc of the apparatus is immediately in front of him.



World's First Radio Movies

**[Westinghouse Electric and Manufacturing Co. Announce]
[Result of Years of Experimenting and Research.]**

THE world's first demonstration of radio movies and one of the most remarkable of recent radio developments, was given on August 8, at the plant of the Westinghouse Electric and Mfg. Co., by Dr. Frank Conrad, in charge of this branch of The Westinghouse Company's activities.

Radio movies are a step beyond previous developments in television and required the invention of a number of appliances in addition to a great deal of scientific calculation, synchronism of various high-speed mechanisms, and accurate control of light and radio waves.

Principles Explained

Although the sending of moving pictures by radio, as may well be imagined required many complicated and delicate pieces of apparatus, the principles of the art as explained by Westinghouse engineers, are not beyond ordinary comprehension.

Photography in its simplest form consists of the reproducing of spots of light and shadow in the same arrangement as they appear in the subject photographed. The screening of a motion picture, of course, requires that a roll of film be operated at a speed which sends sixteen pictures a second before

a projecting beam of light. Because of the structure of the human eye, if a series of pictures follow each other at the rate of 16 or more per second, the human eye sees it as a single moving picture.

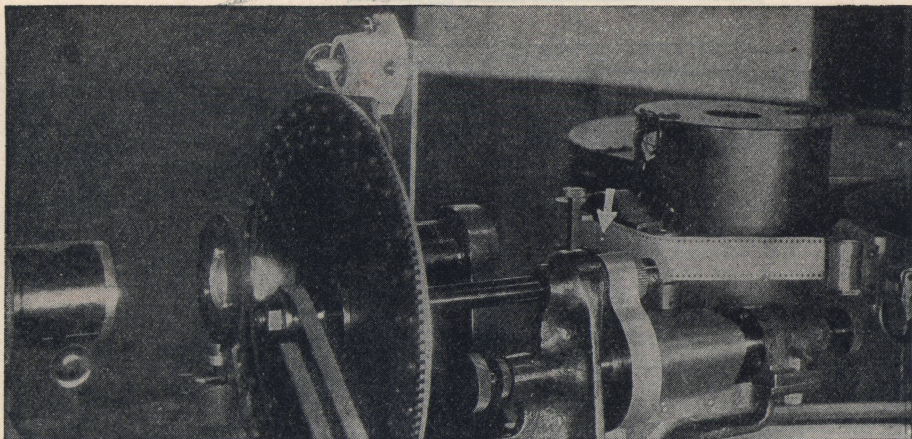
Add Radio to Movies

All this the broadcasting of radio movies requires, with the addition that the spots of light must be transformed into frequencies, some of which are in the audible range, transferred to a radio wave and broadcast as electrical energy. In receiving the pictures, the process is reversed, the electrical energy is picked up, and the frequencies returned to lights and shadows, which when viewed presents the radio movie.

In the first step of the process a pencil of light traverses each picture, or "frame", as it is called, at the rate of 60 times a sixteenth of a second. This process produces a 60 line picture, as clear as the usual newspaper halftone illustration.

"Scan" Each Picture

The pencil of light is produced by a scanner which is a disc with a series of minute square holes near its rim. The disc is so arranged that all light is excluded from the film except that which



The heart of the television motion picture transmitter. The scanning disc is clearly shown as well as the dot of light (see arrow) which is thrown upon the motion picture film. Above the scanning disc may be seen the synchronizing tube which keeps this disc turning at a predetermined speed.

goes through the square holes. The disc turns very fast, and as it turns passes the beam of light across each "frame", with the result that an individual beam of light touches every part of the "frame".

The beam of light passing through the film falls upon an electric eye or photo-electric cell, which is not unlike an oversized incandescent lamp. Within the cell, however, is a metal whose electrical resistance varies with the light falling on it. Caesium a rare metal is used in the Westinghouse cell. The amount of light falling on this cell determines the amount of current passing through it. The result is that each individual beam of light sends an electrical impulse which varies directly according to the amount of light or shade in the film through which it passed.

Light Beams Become Radio Waves

The beams of light have now become electrical impulses and are sent on to the broadcasting station. Here the beams assume definite and varied frequencies, some of which are audible. Dr. Conrad states that these frequencies range from somewhere near 500 to approximately 60,000. Since the human ear is limited to frequencies of approximately 15,000 much of the radio movie wave is inaudible.

Range Unlimited

At the broadcasting station these frequencies are transposed on a radio wave and transmitted exactly as the ordinary music or voice. The radio signals now can be sent across a room, or across the

continent. Their distance range is limited only by the broadcasting station's equipment.

In the Westinghouse demonstration, the signals traversed a distance of about four miles; two miles from the laboratory to the broadcasting station by wire and two miles back to the laboratory by radio.

To turn these radio waves back into light, an arrangement which permits the use of a mercury arc lamp is used.

By this adaptation the weak radio currents control the action of the many times more powerful current operating the arc lamp. This action may be compared to the action of a radio tube, where the weak radio current on the grid of the tube controls the action of the independent and more powerful plate current.

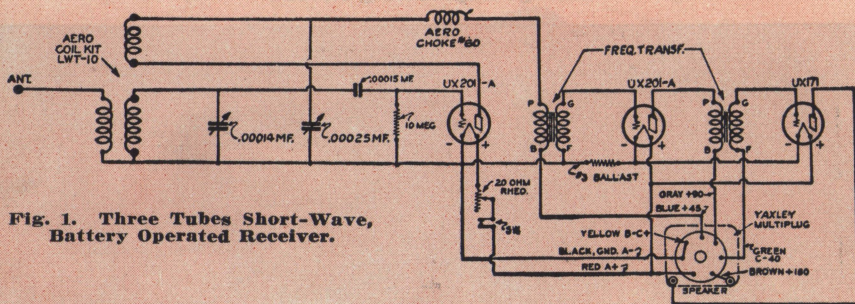
Thus the mercury arc lamp goes bright or dim as fast as the current changes and its light at any instant is in proportion to the light that the electric eye sees in the same instant. To return the dots of light to their original pattern, another revolving disc or scanner is also used which is similar to the transmitting scanner.

The use of a mercury arc lamp permits the radio pictures to be thrown upon a groundglass or screen, the first time this has been done with television apparatus.

Scanning Discs Synchronized

Both these scanning discs turn at exactly the same speed; the hole in the

(Continued on page 22)



Why Not Try the SHORT WAVES?

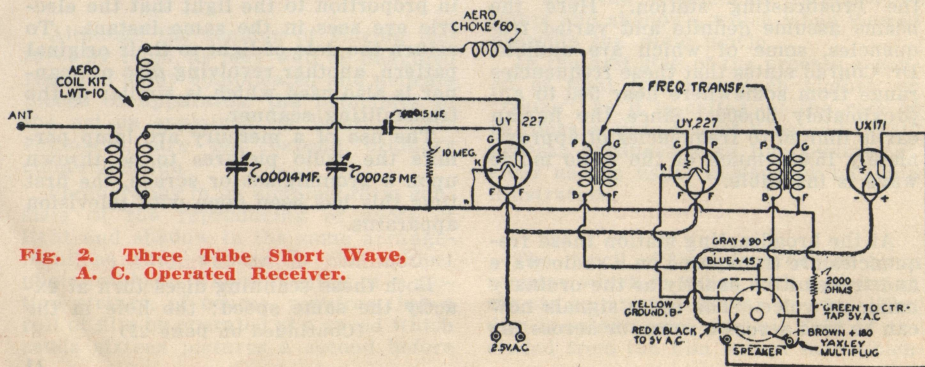
AT the present time a great deal of experimental work is going on in the short wave field. For example, the General Electric Co., at Schenectady, N. Y., is conducting broadcast programs on wave lengths of 21.96 meters, 30 meters, 32.7 meters, and 35 meters. The Westinghouse Electric and Mfg. Co., of E. Pittsburgh, Pa., are trying out similar experiments on wave lengths of 26.3 meters, 42.95 meters, and 62.5 meters.

Regular musical programs are put on the air on short waves, so it is not necessary to know the Code to experiment along this line. For short wave work, a 3-tube set is quite sufficient. Fig. 1 shows a schematic diagram of a good 3-tube short wave receiver. No ground connection is used, the aerial is hooked right on to the tuning coil, and the other end of the primary is hooked to the secondary coil. Tuning is done by means of a .00014 Mf. condenser. Regeneration is controlled by a .00025 Mfd. condenser. Notice that a high resistance grid leak is used, and is hooked between the grid leak and the negative filament of the tube instead of in par-

allel with the grid condenser as is the case with the regular receiver.

The circuit to the right of the detector tube is a standard audio frequency amplifier just the same as is used with the regular receiver. Two stages of audio frequency amplification are used, and the multiplug is convenient for connecting to your battery and speaker. In this set standard Aero coils are used. Different coils are provided, and they are of the plug-in type so that you can readily remove one group of coils and insert others. It would be impossible to cover the entire wave band that the short wave stations are broadcasting on with one set of coils, therefore, you need interchangeable coils so that you can readily switch from one wave length to another. The Aero coil kit L.W.T.-10 is suitable for this particular set.

It is possible to purchase a complete kit containing the parts for building the entire receiver, or a kit can be secured including only the coils, and the remaining parts of almost any make. The parts recommended on the schematic diagram



Building a Converter

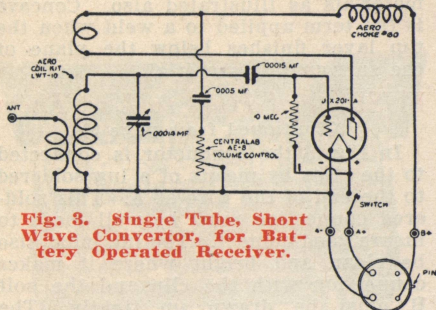


Fig. 3. Single Tube, Short Wave Converter, for Battery Operated Receiver.

are very good ones. With the coil kit, the baseboard and panel layout is supplied. Fig. 5 shows the assembled set with three tubes in position. For alternating current operation, using the new alternating current tubes, Fig. 2 is recommended. Notice that this is the same as Fig. 1, except that the filament wiring is changed to take care of the alternating current tubes. The assembly would be the same as is illustrated in Fig. 5.

"After the equipment has been mounted and wired according to the standard diagram furnished with the coil kit, filament and battery connections are made to the multi-plug. Solder all connections securely. This is very important for loose connections that cause only slight noises in the regular receiver are magnified many times when working on short waves.

The set is now ready for operation. Tune to different wave lengths by moving the .00014 Mf. condenser. The only purpose of the .00025 Mf. condenser is to control the volume. After you have adjusted this volume control, vary the tuning condenser again slightly to get the best reception.

It may be necessary to adjust the filament temperature of the detector when using different tubes, as well as the resistance of the grid leak, until the most sensitive adjustment is found. Try out each one of your tubes as a detector, as some tubes are much better for detector purposes than others. In building the set, be sure that first-class parts such as tubes, condensers, and transformers are used, as this is necessary to get clear and satisfactory operation. The standard aerial anywhere between 75 and 125 feet is used with this set.

Where the radio experimenter already has a radio set with two stages of audio frequency amplification, a very simple converter can be constructed that will allow the use of the set and receive on the short wave. All that is needed is a one tube circuit that will act as a detector for the short waves, then the output of this unit is fed into the detector of the standard radio receiver.

Fig. No. 3 shows the schematic diagram to use when the converter is to be used with a set that has direct current tubes. The Aero coil kit L.W.T.-10 is used in building this set. One variable and two fixed condensers are required, and a centralab AE-8 volume control is recommended to control the regenerative circuit in this set. A 201-type tube is shown, but if the set uses a tube of the 199 type, you should use a 199 type tube in the converter.

The equipment is mounted according to Fig. 6, then wired according to Fig. 3. Be sure that all connections are carefully soldered. In the lower right hand corner of the diagram is shown the base of an old tube that has burned out. Simply break the glass, and tear out the grid, plate and filament construction from the old tube. Then connect the three wires to this base, and plug into the receiver socket that acts as a detector. This tube base plugs into the standard receiver detector socket, and the detector tube is mounted in the short wave converter.

In this set tuning is accomplished by varying the .00014 Mf. condenser, and the volume is controlled by varying the centralab AE-8 volume control. To receive different wave lengths, plug in the different coils. One coil is designed to

(Continued on Page 15)

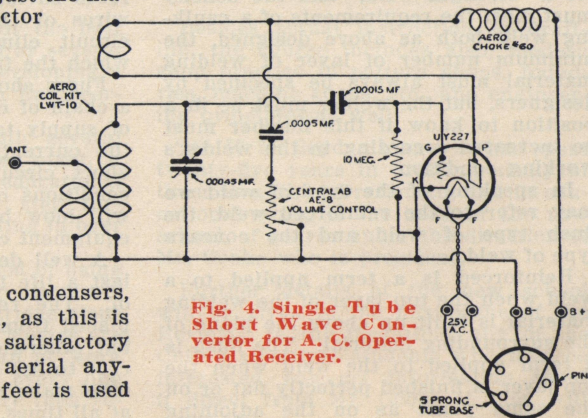


Fig. 4. Single Tube Short Wave Converter for A. C. Operated Receiver.

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ELECTRIC ARC WELDING

(Continued from page 8)

strength of a chaulking weld is not of material importance, neither is the design of the weld of this kind necessary of consideration.

The strength weld is one in which the sectional area of the welding material must be so considered that its tensile strength and elongation per square inch must equal at least 80% of the ultimate strength per square inch of surrounding material. The welding material can be applied in any number of layers.

The density of the crystalline metal is not of vital importance. In this form of weld, the design of the weld must be specified by the designer and followed by the operator.

The composite weld is one in which both the strength and density are of the most vital importance. The strength must be at least as specified for a "strength weld," and the density must meet the requirements of a caulking weld both as above designed, the minimum number of layer of welding material must always be specified by designers, but the welder must be in a position to know if this number must be increased according to the welder's working condition.

In speaking of the type of weld we may refer to the reinforced weld, the flush type of weld and the concave type of weld.

Reinforced is a term applied to a weld when the top layer of the welding material is built up above the plane of the surrounding material. The flush is a term applied to the weld when the top layer is finished perfectly flat or on the same plane as on the adjoining

materials as illustrated also. Concave is the term applied to a weld when the top layer finishes below the plane of the surrounding material.

FUSES and How to Use Them

(Continued from page 9)

In Fig. 5 the conductor is connected to the clips by means of a lug soldered to the end of the wire at A. This soldered connection must be well made to insure good contact. The lug must also be clean and bright where it makes connection with the clip and the bolt B must be drawn up tightly. The screw C which fastens the clips to the fuse block, must hold it tightly and firmly in position.

The fuses discussed so far are of the ferrule contact type. Another type which is used a great deal is that having a knife blade contact. With this type the blades of the fuse and the inside of the clips should be kept bright and clean and this should be done so that very fine contact is made with the blades of the fuse. If the clips have been damaged or bent, they may fail to make good contact with the blades of the fuses as in Fig. 6. In the three illustrations shown in this figure, a very poor contact exists and should be improved either by adjusting the switch so that the knife blades of the fuse fit snugly or by installing new clips.

Whenever fuses are replaced, the ones which have been burned out should be carefully inspected, to see if the trouble has been due to poor contact and in all cases the clips should be examined and gone over with emery cloth if necessary.

It is not uncommon practice where fuses blow frequently, to replace them with larger ones. This is very poor practice, however, because the use of fuses having greater capacity than the wires or the machines supplied by a circuit eliminates the protection for which the fuses were intended.

Fuses should be the weakest link of a chain of connections from the source of supply to the equipment consuming the current, so that when overloads, short circuits or any other unusual conditions occur on the line, the fuses will blow before injury to any of the equipment can result.

A well designed renewable fuse will last a life time if properly taken care of. The renewable link must be replaced from time to time when blown, but otherwise, no care is required except to see that the metal parts of the fuse make good contact with the clips at all times.

WHY NOT TRY THE SHORT WAVES

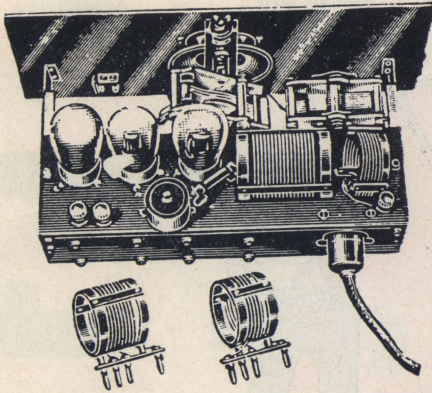


Fig. 5

(Continued from page 13)

operate between 15 and 33.5 meters, one to operate between 31.5 and 68 meters, and the third to operate between 57 and 133. When you want to change from one group of wave lengths to the other, change the coils.

A similar converter can be built for the radio set that uses alternating

current tubes. A wiring diagram of this set is illustrated in Fig. 4. Notice that practically the only difference is in the filament wiring. The equipment would be mounted just the same as in Fig. 6 for the direct current converter, but the tube must be an alternating instead of a direct current one.

It is absolutely necessary that high grade parts be used throughout the receiver to get satisfactory results. The radio frequency choke coil is a very important part of the unit, and Aero products are recommended throughout.

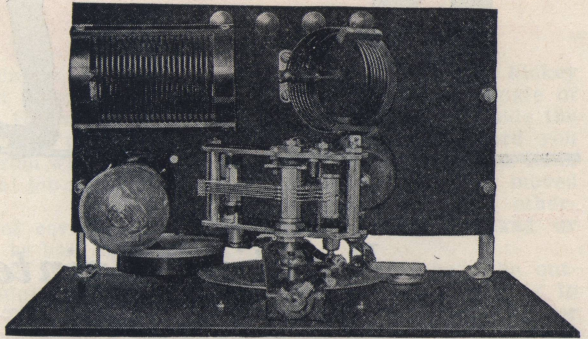


Fig. 6

* * *

New Home Study Course In **DRAFTING**

*Chief Adds Entire New Course of Training to His Schools
Selects K. M. Boyd to Head Instruction as Chief Drafting Engineer.*

During part of his time for the past two years, the Chief, assisted by several other engineers, has been developing a new course of instruction in Engineering Drafting.

It was offered to the public several months ago, and almost over night, it was acclaimed as a great educational achievement, and the only step forward in the teaching of drafting in over thirty years.

In this new course a method of using a moving picture camera to illustrate the lessons and show the various steps in the work was developed. Movies are taken of an expert draftsman at work so as to get every detail of every line he draws. These pictures are then reproduced in the lessons.

Besides actual instruction in drafting, the course includes also, modern shop practice in pattern shops, foundries, machine shops, etc., and engineering principles as well.

Mr. K. M. Boyd, a man who has spent twenty-five years in drafting, many of them as a Chief Draftsman, and in educational work, is the head of the new school, of course under the direction of Mr. Cooke who is president.

Further details of the new school will be given in the next issue of the Review. In the meantime, any of the Chief's electrical students who may be interested, can get information about it direct from Mr. Cooke if they will write him.



Figure 2

Figure 3

Figure 4

Practical Pointers on Conduit Installation

THE development and enforcement of more rigid rules and restrictions, governing wiring installations, especially in large cities, during recent years, has led to the use of conduit more and more for wiring installations.

Conduit provides protection for the wires, so that the danger of mechanical injury is almost entirely eliminated and now, a great many of the larger cities require that all wiring be installed in conduit, either rigid or flexible, or steel covered cable, commonly called B. X.

Rigid iron conduit is used almost exclusively in the wiring of residences,

office buildings and factories where the wiring rules do not permit the use of knob and tube and cleat wiring, if the wiring is done while the building is under construction.

There is a wide variety of fittings and condulets for conduit wiring, a number of the more common ones being shown here. The different types are all designated by letters and it is well for the electrical man, doing construction work, to become acquainted with the common types and the letters by which they are designated. Manufacturers of condulets such as the Crouse Hinds Co. make so many different kinds of con-

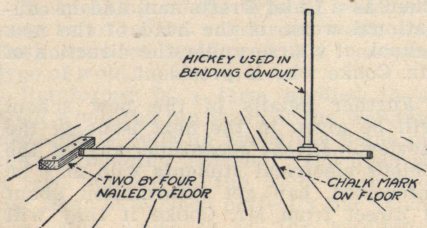


Figure 1

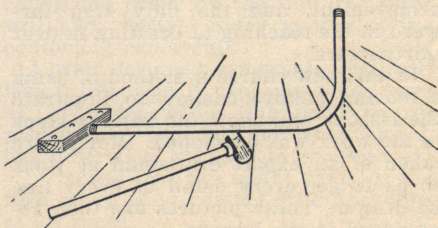
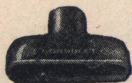


Figure 3



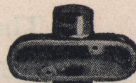
TYPE A



TYPE B



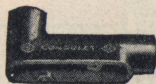
TYPE C



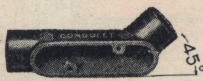
TYPE D



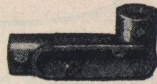
TYPE E



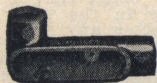
TYPE LB



TYPE LRB



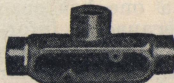
TYPE LR



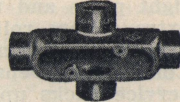
TYPE LL



TYPE LF



TYPE T



TYPE X

Some of the More Common Fittings and Condulets Used in Conduit Wiring

duit fittings, to fit all imaginable requirements, that it is almost impossible to remember all of them. However, all types are shown in catalogues published by the manufacturers from which the proper ones for any special job may be selected.

A good idea of the uses of several types of conduit fittings may be had in the illustration on page 22, which shows the installation of conduit for a large motor driven planer. There are a number of different types of condulets used in this installation and the uses of each may be seen.

In most conduit installations, a change in the direction of a conduit run is made by bending the conduit because it is generally cheaper, quicker and more convenient to make bends than to use conduit fittings.

Making bends in conduit, especially where the bends must be accurately made so the conduit will fit in a limited space, requires considerable skill. The tool most commonly used for bending conduit in small sizes, $\frac{1}{2}$ " and $\frac{3}{4}$ ", is the hickey, one type of which is shown in Fig. 1.

To make a right angle bend with a hickey, first determine exactly where the bend is to be made by measuring with a folding rule. Then lay a piece of conduit on the floor with one end resting against the wall, or against a block nailed to the floor, after having drawn a chalk line as in Fig. 1, showing exactly where the bend is to be made. Place the hickey on the conduit about 2" or 3" outside of the chalk mark as in Fig. 1, then stand on the conduit with one foot against the hickey

and by pulling on the end of the hickey draw the conduit through an angle of about 20° as in Fig. 2. Next slide the hickey down on the pipe toward you about 1" and bend the conduit a little farther. The hickey must be moved slightly after each small bend, otherwise the conduit will be kinked or cracked.

When the bend is finished, the outside of the bend should be directly in line with the chalk mark on the floor as in Fig. 3. It is easy to judge approximately, when the bend is being made, whether the outside of the bend is going to be in alignment with the chalk mark, if it is carefully watched.

Offset Bends in Conduit

Next to the right angle bend, the offset bend is used perhaps more than any other in conduit work. It is more difficult to make than the right angle bend, but a little practice will enable anyone to make such a bend satisfactorily.

The first step in making an offset bend is the same as the first operations in making a right angle bend as shown in Fig. 1.

The second bend of the offset may be made as shown in Fig. 4 or as in Fig. 5. The method shown in Fig. 4 is just a little more convenient and satisfactory where it is possible, but a satisfactory offset may be made, using the method illustrated in Fig. 5.

Another type of bend which is used very extensively in passing conduit runs around obstructions is the double offset. It is very hard to make this type of bend

(Continued on page 22)

The BEST TRAINING Brings the BEST JOBS

*Cooke Trained Men are
"Putting it Over" in Every
Branch of Electricity*

*—And the Same Train-
ing that Boosted Them
Will Boost You, Too*



Consultation Department Help Worth \$100 in a Month

Many a man has been pulled out of a tight place and many a one has seen extra dollars roll in because of information given him through the Chief's Consultation Department. This superior service backs up Mr. Cooke's training 100 per cent! San Pedro, California. Dear Mr. Cooke:

Within the last month by applying the information and following the advice given me by your consultation department I have gained well over a hundred dollars.

I appreciate the straight-forward business like method of your department, and thank you for the service.

Sincerely yours, ELMER H. WRIGHT.

"Seventeen Year Old Kid" Makes Good

"Not bad for a seventeen year old kid" says Joe Mullin, speaking of what Cooke Training has done for him, and we believe you'll agree with him. "Joe" writes a mighty interesting letter which offers a tip for other young fellows who feel blue once in awhile over their lack of progress.

130 Montana Avenue,
Whitefish, Montana.

Dear Chief:

Two years ago things looked bad. I didn't have a job or much money to go to school on. I always had an ambition to be a success so one dark day after receiving one of your letters I enrolled for your Course. I studied hard and finished in a year. Last year finding a job wasn't hard and this year even easier, the job hunted me. I am now a helper for the Mountain States Power Company on the Whitefish Division. I only get four dollars a day, but I'm telling you that's good wages for a seventeen year old kid, considering that most others of the same age and many others that are older, get much less. On top of that your course made physical science (commonly called physics) and chemistry so easy for me in high school that I was enabled to win a scholarship to Montana State College. Thus it has insured me virtually a college education. Needless to say I have a very high regard for your course in electricity and strongly recommend it to anyone who wants to get into the game and go far in it.



Joe A. Mullin

I am enclosing a snapshot of myself in "line togs." I suppose you see many pictures everyday of fellows similarly rigged out, but I don't think it's very often that a "seventeen-year-old-kid" is in the harness. You can use this letter any way you see fit and if at any time I can be of any service to you just let me know. As ever,
An enthusiastic student,
JOE A. MULLIN.

"Other Schools Don't Give What You Do"

Hundreds of men have said that to Mr. Cooke. Hundreds of others have asked him how he can afford to give them all he does for the small sum they pay. Of course, that's the Chief's problem, his students don't have to worry about that. But to let you in on a little secret—it's the Chief's students that help him keep down the cost of his training. Cooke students are loyal. They are boosters. They never hesitate to say a good word for their school. This great good will on the part of his students is a wonderful help to Mr. Cooke.

Greencastle, Indiana,
P. O. Box 186.

Dear Partner:

Mr. Cooke I want to thank you again for what you and your wonderful school has done for me. When I enrolled with you I was earning ten dollars a week and now after completing the course, my weekly earnings are often as high as \$100. Last week with the aid of one helper I cleared one hundred and twenty-three dollars, not so bad considering that I have only been in the game since the latter part of May this year and with five established electricians in this small town of three thousand people.

Mr. Cooke can you explain how you can do all that you do for us fellows with such a small tuition charge? Other schools don't give what you give for almost twice the price of your course.

Why have I been able to do the things I have done? Well it's like this, when a fellow enrolls with your good old school and is willing to study he just learns, that's all.

Yours for eternal success,
RALPH CROUSORE.

"Promotions Come Fast" Says Parker

Earl Parker hit the nail on the head when he said, "Promotions come fast when you know electricity." Thousands of Cooke Trained Men have learned this fact and hundreds more are learning it now.

5430 Orchard Street
Bedford, Ohio

Dear Mr. Cooke:

Regarding my job at present—when I started into the electrical field in March, I had no experience to speak of, but I had my diploma from your school.

At the present I am in charge of switchboard construction and control work which includes all switchboard instruments and meters, all secondary circuits to the high tension lines, control of all oil circuit breakers and also all relay circuits.

My salary has been increased a bit over 100% since I started electrical work and just last week the Chief Operating Engineer, Mr. W. E. Campbell, spoke of another increase in salary to be effective January 1st.

Promotions come fast when one knows electricity and your course teaches that very forcibly. Your course is worth many times the money and effort put into it.

You may quote any or all of this letter to your students.

Yours,

Earle E. Parker

Employer Says "Study More and I'll Pay You More"

If you want to get a line on what employers think of their men studying, just read this letter sent down from Vancouver by student C. A. Windsor.

Already his salary has gone up \$25 a month through studying the Chief's Course and his boss promises an additional increase if he will go ahead with his lessons.

Vancouver, Washington
1710 Railroad Avenue

Dear Mr. Cooke:

Some time ago I told you that I was going to resume my studies and asked you to write my employer and give him my grades.

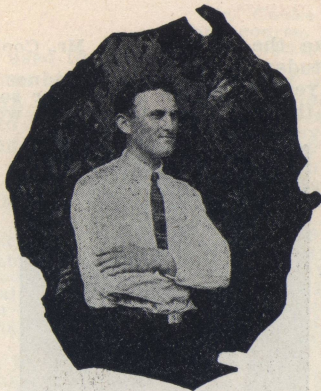
Soon after you sent him a letter, he raised my wages at the rate of \$25 per month.

It seems that he has been receiving reports from you and told me the other day to study more than I had been because he wanted to raise my wages again, but couldn't as long as I didn't study.

This is my fourth lesson since then so I want you to tell him I have started again.

Very truly yours,

C. A. WINDSOR.



Earle F. Parker

Promoted to Mine Electrician

Alfred Ernes is another student who found promotion awaiting for him. Even long before his course was completed, his boss recognized what study had done for him and rewards his efforts with promotion to a more important job and increased pay.

627 W. Washington Street
Martins Ferry, Ohio

Dear Mr. Cooke:

I'm very sorry that you had to wait so long for a reply to your letter, but I believe that you'll forgive me when you know the cause of the delay.

Well! to make a long story short, I have been promoted, to mine electrician since the first of July with a raise in salary of seventy-five dollars a month.

I'm very sorry that I had to let up on my course for a while, but the work on this new job had been previously neglected so that I had to work hard to put everything in good shape, but I'm about ready to start again and this time I will go through with it.

I want to thank you for your interest in me and thanks to your Course for my success in the field.

Your student and friend, AL. ERNES

Earns Four Times Previous Salary

Quitting a job and getting a better one, for which you are fitted by training, is one way of going ahead. But sticking with your employer and earning promotion with study is a better way. That's what Arthur Payette did.

He studied for a better job and the chief made his efforts known to his employers — Result—a better job—more money.

1419 24th Street,
Detroit, Michigan.

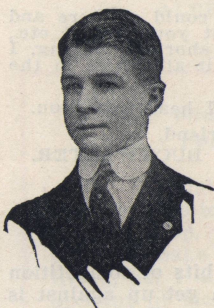
Dear Friend:

I've been placed in charge of our hammer shop. Before going any further I wish to

thank you most sincerely for having written to one of the head men of this plant as I'm sure that it is your letter that helped me to get this new job. Just think, since I've taken up your course I've increased my income four times more than what I was getting before I enrolled for your wonderful course in electricity. Thanking you once more for your wonderful help.

I remain your student and booster.

ARTHUR PAYETTE



Arthur Payette

Finest School in the Country

Fort Monmouth, N. J.

Herbert Buckwalter, like the thousands of other Cooke Students who visit the laboratory each year become enthusiastic boosters for this feature of the Chief's training. Some of Mr. Cooke's boys who have not visited the school have the idea that his laboratory is more or less "bunk". But it takes the fellows who have spent a couple of weeks here to tell you it's the greatest place they ever saw.

454 Wilton Street,
Philadelphia, Pa.

Dear Mr. Cooke:

Well, vacation is all over and I must write and tell you how much I enjoyed my visit to the Chicago Engineering Works, and to Chicago.

Believe me, Mr. Cooke, I never realized what an organization you had, or what a capacity for work you must have, and above all allow me to state that the equipment you have in the "Lab" is A No. 1, and the cleanliness of it all impressed me very much. Your assistants in this branch of the work deserve a lot of credit, because I know that it is only through hard work that things are kept like that.

I often wondered why you located in Chicago, but after my visit it is very easily explained, the town itself is wonderful, best town I have ever been in, more progressive than Philadelphia and New York combined and that's saying something.

Well Mr. Cooke, I could sit here and write all night about your school etc., but I am cutting it short by saying, I congratulate you on it all, finest in the country.

Well no more till I hear from you.

Your friend,
HERBERT C. BUCKWALTER.

*Other Cooke Students Make Pvt.
Donovan Hustle to Keep Up*

One of the stiffest bits of competition a Cooke student can get up against is another Cooke Student. Private Donovan of the U. S. Signal Corps tells how some of his buddies make him hustle, and he, no doubt is making it just as hard for the others. His letter is just one of many hundreds received by the Chief from his students in both the Army and Navy. Cooke Training has been of inestimable value to thousands of men in these two branches of our country's service.

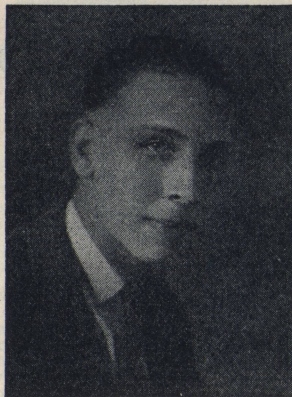
Dear Mr. Cooke:

I have not had time to send in any lessons for some time. But I am going to get to work and work hard from now on. I am going to a government electrical school here and your training makes it easy for me to get the best grades in my class.

I am getting a good rating and from the looks of things I am going to take the head of my class. There are only two men I am afraid of and they are both your students. So you see I have a real reason for being afraid. There are a lot of your students here and all of them are holding good government jobs. Some of them are instructors.

Sincerely your student
and booster,

PVT. H. P. DONOVAN.



Herbert C. Buckwalter

*Selected Out of Thirty Men in Civil
Service Examination*

Hundreds of Cooke Trained men in all parts of the U. S. have found their training 100% helpful when taking Civil Service Examinations. These examinations are designed to find out just how much an applicant knows about the job he wants to get. There can't be any fooling. A fellow either makes the grade or he doesn't. But Cooke Trained always come through.

5230 Ashley Ave.,
Detroit, Michigan.

Dear Friend:

Yes, that is what you have been to me.

If it had not been that I had noticed your advertisement and taken your Home Study Course, I would not have been able to pass an examination that has taken me out of the wandering electrician class and landed me a good job.

I am now in the Civil Service of Detroit, as an Electric Pumping Station Operator.

I am one out of sixty who took the examination and one of the ten who were called back for oral quiz and physical test, and one of the two that I know of, who landed a job.

The other man is at the same station as I am and he has had considerable experience in this line where I have not.

He considered the test rather stiff, so you see I must have gotten considerable out of your course.

Yours with sincere thanks and best wishes to the school.

Your old student,
ELVER I. CARROLL.

Cooke Training Doubles Income

Frank Glashaw says he used to hunt for a job but now people hunt him when they want electrical work done. It doesn't take people long to find it out, when there's a man around who really knows his business.

St. Ignace, Michigan

Dear L. L.

A few words for the course.

Three years ago I was shoveling coal for a railroad company. Today I have a contract for a motor installation to do this same work I was performing when I was working for them.

Before taking the course I was compelled to go hunting for a job. Now people call me up and ask when I will be in a position to do their work.

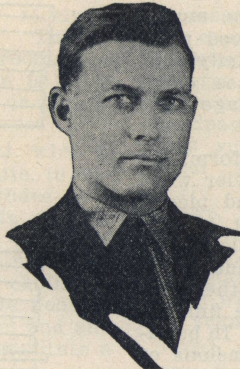
My income since completing your course is exactly doubled.

I hold the position of Chief Electrician here in this city, it gives a fair steady salary and does not take up much of my time. Just now I have two other wiremen working for me on a contract job. All interior wiring and alterations are my own private jobs while all pole and outside line construction are city affairs.

I will heartily recommend your Electrical Course to anyone in the electrical game. The college man will profit by it for its practical methods and the grammar school man can gather all the meaning because it's not complicated. I might add that I have only a grammar school education myself and I graduated last December. If there is anything I can do for anyone in the line of information in regards to the course or the school, I will be more than willing to give it.

Yours very truly,

FRANK L. GLASHAW.



Frank L. Glashaw

Mr. Cooke in March 1926 I started your course, I knew nothing practically of electricity, when I received my lessons I put all my spare time on them and then I started on repair jobs, wiring houses and etc. In September 1926, I started to work for the Scranton Electric Company constructing out door substations. When we had them nearly completed in June 1927 they layed off men who had been working there for many years, but I was kept on until the station was completed which was in September 1927, then I realized that success comes thru study. I then came to Elmira, N. Y., on a visit. I was informed that E. L. Phillips was constructing a substation there for the Elmira Water and Light Company.

I went to see if I could get work with him. The first thing, I saw was a sign, "No men wanted" but I went in and talked with a few of his electricians and they told me that he had layed off 20 last Saturday and that there was only 50 of them left. But I went in and saw the Chief and he asked me if I had any constructing experience and I told him I had and was also taking a Course with you. He then asked me a few questions and I was sure there with an answer. He told me to come out in the morning. We completed the station in December 1927 and they layed off all men but five and Mr. Cooke thru your training I am one of the five they have kept.

Mr. Cooke, I will always remember that your school has been responsible for putting me where I am today. I hope that every man who is looking for success will do the same as I did, and that is enroll with your school.

Yours for Success,
ALBERT WEISENFLUK.

The Trained Man Keeps on While Others Are Laid Off

How often have you heard that story before? And you are going to hear it even more often in the years to come. When work is plentiful and men are scarce employers will take anyone they can get. But when times change and there are more men than jobs—look out if you are untrained. See what Al. Weisenfluk says about it.

269 Lormore St.,
Elmira, New York.

Dear Mr. Cooke:

This is a letter I should have written to you before and I really feel ashamed that I waited until I finished my 49th lesson to thank you for putting me on the road to success.

Battery and Electric Shop For Sale

Will sell only to a Cooke Student, my up-to-date battery and electric shop. Business is good and will make a good man a fine living, but I am forced to sell on account of sickness. Equipment includes up-to-date charges, Test Benches, Tools, and stock of new and rental batteries. Located on Main Street—rental low.

Price at \$3,000. Write to

L. J. Drake
1347 Wabash Avenue
Terre Haute, Ind.

Practical Pointers on Conduit Installation

(Continued from page 17)

with a hickey, so in most cases it is worth while to construct a bending form, as in Fig. 6. If the materials are convenient, the form can be made in a few minutes times, providing a means of making double offsets uniformly and rapidly. The bending form, consisting only of four pieces of wood shaped as shown, may be nailed directly to a work bench or any other convenient place.

To make a good long-lasting, sturdy form it is best to select a good piece of hard wood that will not easily split and fasten the several pieces down with good sized stove or carriage bolts and nuts.

Notice that in the bending form, the two middle blocks are of heavier wood and extend above the two end pieces. The piece of straight conduit is first placed between the two middle blocks as in Fig. 7 and the two inside bends made as in Fig. 8, after which the other two bends are completed, the finished bend being as shown in Fig. 9. In building the form, the exact dimensions of the double offset must first be determined and the blocks composing the form shaped accordingly.

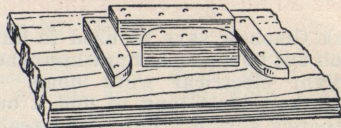


Figure 6

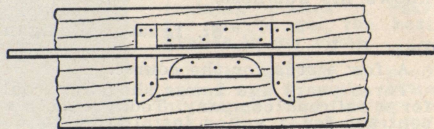


Figure 7

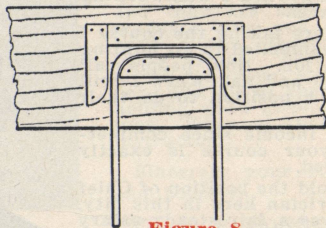


Figure 8

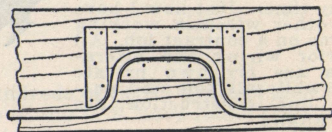


Figure 9

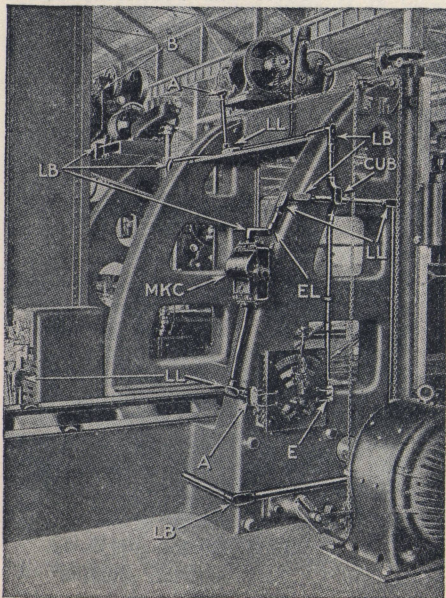
WORLD'S FIRST RADIO MOVIES

(Continued from page 11)

receiving disc must be exactly in the same relative position as the corresponding hole in the transmitting disc. In other words, they must be synchronized.

Use Radio Wave to Synchronize Discs

Westinghouse engineers were the first to develop a feasible method of synchronism and their method was by means of radio. From transmitting equipment, which may be located in the broadcasting station, they transmit a constant frequency wave of 5,000 cycles. This wave is produced by a tuning fork and transmitted over a special carrier wave from the broadcasting station. The constant frequency note is received on a special receiver and by means of special apparatus controls the speed of synchronous motors, which drive the scanning discs of both transmitting and receiving radio movie equipment. This revolutionary method of controlling equipment indicates, in a measure, the extent to which science must go in order to perfect—say television, or radio movies.



Several types of Condulets used in Motor
Installations on Large Planer

How Polarity Wiring Prevents Shock

MANY wiremen know that polarity wiring is known to be safer than the old method in which the shell and contact sides of the sockets were connected "helter-skelter" but do not exactly see why this is so.

Aside from the importance of keeping single pole switches in the ungrounded side of the line by the use of color wiring, there is another angle to be considered—that of receiving shocks from lamp sockets. This is especially important in bathrooms and in basements where a person is likely to touch a socket, and pipes or plumbing at the same time.

In the sketch the neutral wire is grounded as usual and is white, to distinguish it from the ungrounded conductors. When the shell side of each socket is connected to the grounded side of the line, there can be no difference in potential between the shell side of the socket and the concrete floor or between the shell of the socket and any plumbing, because they all constitute a part of one side of the line.

If any part of a socket becomes grounded to the brass casing of a socket, it will most likely be the shell side. In the event the shell becomes grounded to the casing nothing can happen. You can touch the outer cas-

ing and any plumbing without danger of shock. If polarity wiring is not maintained, then, you have an excellent chance of receiving a shock; about one chance in two, on the average.

Sandpaper Block for Cleaning Commutators

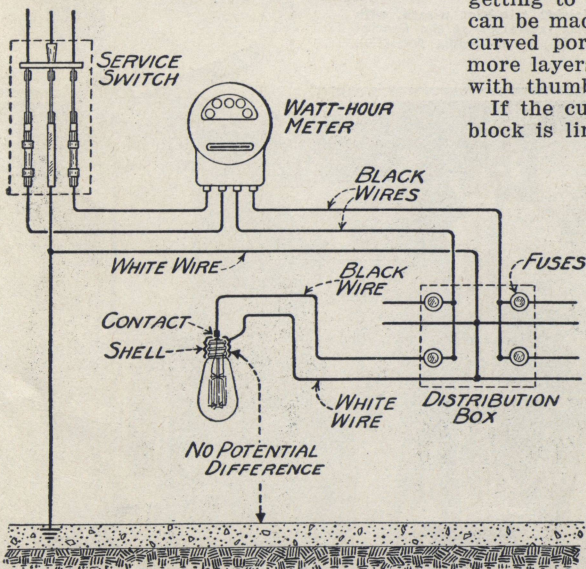
Very often it is necessary to clean the commutator of a motor as a temporary means of reducing sparking. Sandpaper is a very suitable material for this. Every maintainer knows, of course, that emery will not do because of its metallic composition which shorts the segments.

With small motors it is sometimes very difficult to clean the commutator because of the frame construction which does not permit getting to the commutator. The block can be made any size, as required. The curved portion is covered with one or more layers of sandpaper held in place with thumb tacks as shown.

If the curved or grooved part of the block is lined with felt or similar material before the sandpaper is placed on the block, the sandpaper will conform with the surface of the commutator and do a much better cleaning job.

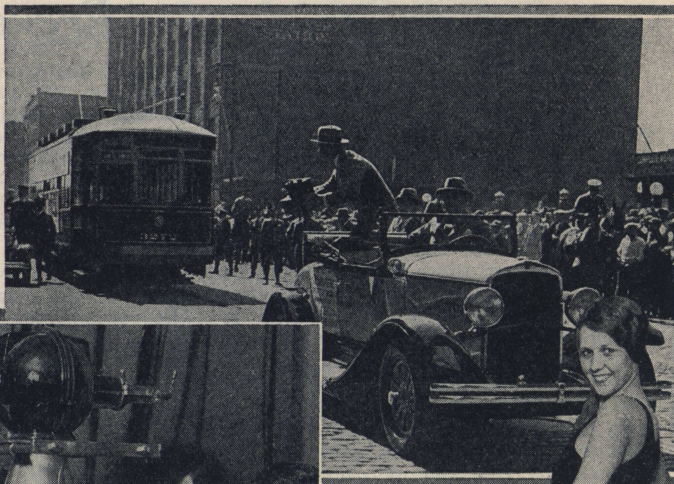
When working with large motors in ceilings, the block will be found especially helpful since it is necessary that the maintainer support himself with one hand while working with the other.

A similar block with a flat surface can be used for cleaning collector rings on both small and large motors.



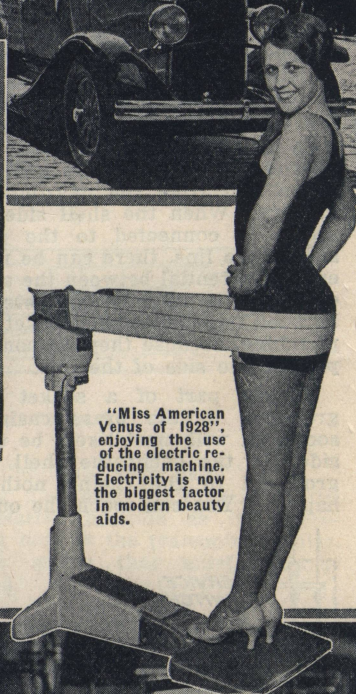
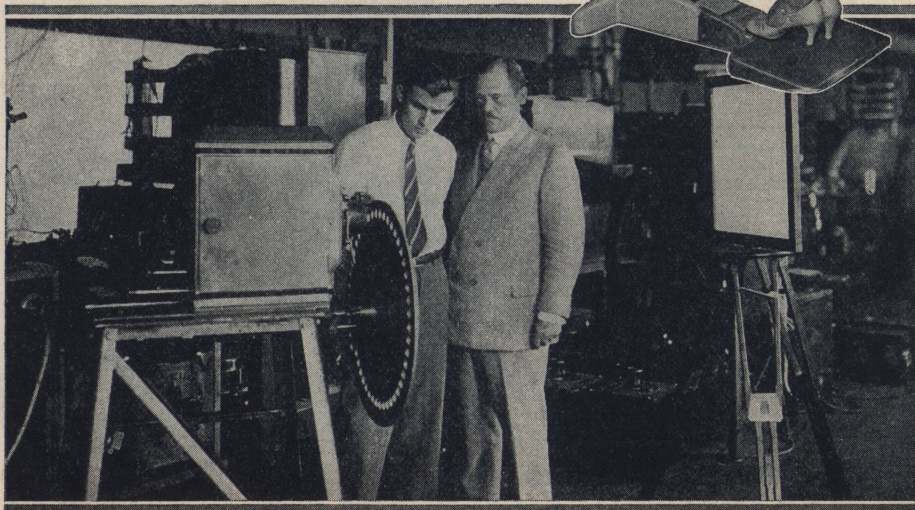
WHAT'S NEW IN ELECTRICITY

Operated by radio control, with no hand at its brakes or motor, a street car of the Chicago Surface Lines made a trip from Harrison street to Grand avenue. The experiment of operating the car by radio was carried out by Maurice J. Francill, a radio expert, who rode in an automobile in front of the car.



Three-Month-Old "Spitfire", is X-Rayed to discover cause of sudden illness

Below: Dr. E. F. W. Alexanderson (right) television wizard, with his assistant, R. D. Kell, in the former's laboratory at the General Electric Co. testing the latest television improvement—the projection of images on to a screen.



"Miss American Venus of 1928", enjoying the use of the electric reducing machine. Electricity is now the biggest factor in modern beauty aids.